No. 5 — *The placentation of the pronghorned antelope (Antilocapra americana)*

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The pronghorned antelope (*Antilocapra americana*) forms a single species and genus, assigned by Weber ('28) to the subfamily Antilocaprinae of the cavicornia (Bovidae). Weber remarks that some others have assigned a higher and more independent position to it, on an equal level with the families of the cervicornia (Cervidae) and vellericornia (Giraffidae). He, himself, regards it as an animal which has distinct although distant relationships to the Cervidae but is at the same time related to the antelopes or at least to the cavicornia in general. In its geographical isolation it has followed its own path, becoming specialized as well as retaining a number of primitive characters.

The placentation of this animal does not appear to have been investigated before. The placenta and fetal membranes will be described in the present paper, and they will be compared briefly with those of related animals.

MATERIAL AND METHODS

The material at our disposal consists of 4 pregnant uteri. Two of them were obtained from the Montana Fish and Game Department through the assistance of Dr. Philip L. Wright of Montana State University. The 2 others were received from Dr. Charles H. Rouse of the Fish and Wildlife Service, U. S. Department of the Interior.

Each of the 4 uteri contained twins, of which 3 pairs were of opposite sexes but in 1 case both were males. The members of the respective pairs were approximately 18, 21, 23 and 37 cm. in crown-rump length. The specimens from Montana are undated whereas the 2 from Nevada were obtained on February 26 (23 cm.) and April 9 (37 cm.).

The pregnant uteri were placed in 10% formalin, all of them except 1 having been opened to some degree to improve fixation. For purposes of histological topography the specimens are quite adequately preserved, but for detailed histology and cytology their fixation is less good. Despite this, they have yielded important information regarding the character of the placenta and the fetal membranes, and 1 in particular (23 cm.), of which several illustrations are presented, shows quite satisfactory histological detail.

Representative pieces of the placenta and membranes were embedded in paraffin, sectioned, and stained in hematoxylin and eosin, eosin and methylene blue, or Masson's connective tissue stain.

GENERAL TOPOGRAPHY OF THE PLACENTA AND FETAL MEMBRANES

The 4 specimens are very similar in appearance. The relations and topography of the twin placentas and fetal membranes to one another and to the uterus are illustrated semidiagrammatically in figure 1. This drawing was prepared from the youngest specimen which contained fetuses of 18 cm. A fetus and its placenta occupy each of the 2 horns of the bicornuate uterus. The drawing reveals the interior of the uterus with the amniotic sacs opened and the fetuses removed. The fetal membranes are symmetrically arranged in the 2 horns of the uterus with the umbilical cords and allantoic sacs oriented toward the lesser curvatures (mesometrial borders) of the uterine horns. In the right uterine cornu (left-hand side of drawing) the allantoic sac is represented as having had its ventral wall removed.

The chorion is studded with a large number of cotyledons which are located on the dorsal and ventral surfaces of the chorion. The vessels of the umbilical cord divide at the mesometrial border of the chorion into arteries and veins which pass dorsally and ventrally to supply the cotyledons with blood. In figure 1 the cotyledons are seen indistinctly on the left side through the unopened, transparent allantois, whereas in the right cornu, where the ventral wall of the allantois has been removed, they are more sharply outlined.

The cotyledons vary in size. In the youngest specimen (18 cm. fetuses), each placenta consists of a score of large cotyledons, measuring from $1\frac{1}{2}$ to $2\frac{1}{4}$ cm. in diameter and a lesser number of small ones varying from $1\frac{1}{2}$ cm. down to 3 or 4 mm. in diameter. The large cotyledons are located on the dorsal and ventral surfaces of the chorion in zones paralleling the mesometrial border of the uterus. The small cotyledons are more irregularly situated, some being located at the ends and others in the anti-mesometrial region of the elongated chorionic sac. In general they seem to occur in regions which are less favored by the allantoic blood supply.

In the oldest specimen (37 cm. fetuses) the largest cotyledons have attained diameters of $3\frac{1}{2}$ to 4 cm. indicating that they have slowly increased in size. The cotyledons are mainly circular but a few are oval. The allantoic blood vessels entering and leaving on one side lend a racket-shaped appearance to some of them.

Approximate counts of the cotyledons in the 4 uteri yield the following figures:

Numbers of cotyledons in each placenta (right and left)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4	
	r	l	r	l	r	l	r	l
Large cotyledons	20	22	32	33	25	27	38	37
Small cotyledons	17	18	16	17	21	20	24	23
Totals	37	40	48	50	46	47	62	60

There appears to be some increase in numbers with age, but whether or not this is a significant and constant feature we do not know.
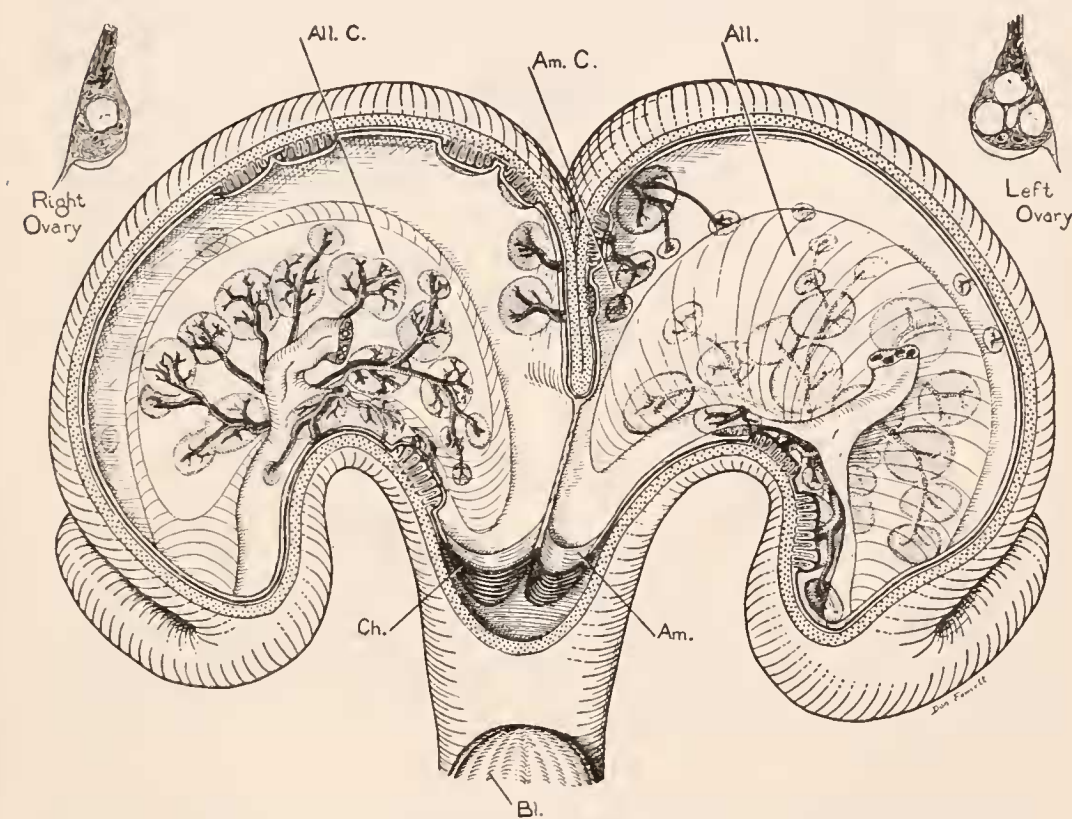

Fig. 1. Diagrammatic drawing of the interior of a pregnant uterus of Antilocapra americana, illustrating the shape and relationships of the gestation sacs. The fetuses (18 cm. crown rump lengths) have been removed to show to better advantage the arrangement of the chorion, amnion, allantois and cotyledons. Observe the fused amnions in the corpus uteri. For further information consult text. All., Allantois; All. C., Allantoic Cavity; Am., Amnion; Am. C., Amniotic Cavity; Bl., Urinary Bladder; Ch., Chorion.   x ¼.

In the upper corners of the diagram cross-sections of the ovaries are presented revealing the presence of 4 corpora lutea.

In the stages of development examined by us the amniotic cavities are much larger than the allantoic sacs (fig. 1). The latter are crescentic in shape conforming to the curving mesometrial borders of the uterine horns. Each allantoic sac presents an outer vascular surface which is fused with the dorsal wall of the chorion to constitute the allantochorion and an inner surface which is avascular and transparent. The degree of fusion of chorion and allantois varies considerably in individual placentas. For example, in 1 of the specimens the allantois in 1 gestation sac is fused extensively with the chorion, whereas in the opposite chorionic sac the area of fusion is relatively slight. The relationships of the allantois, chorion and amnion in a transected uterine
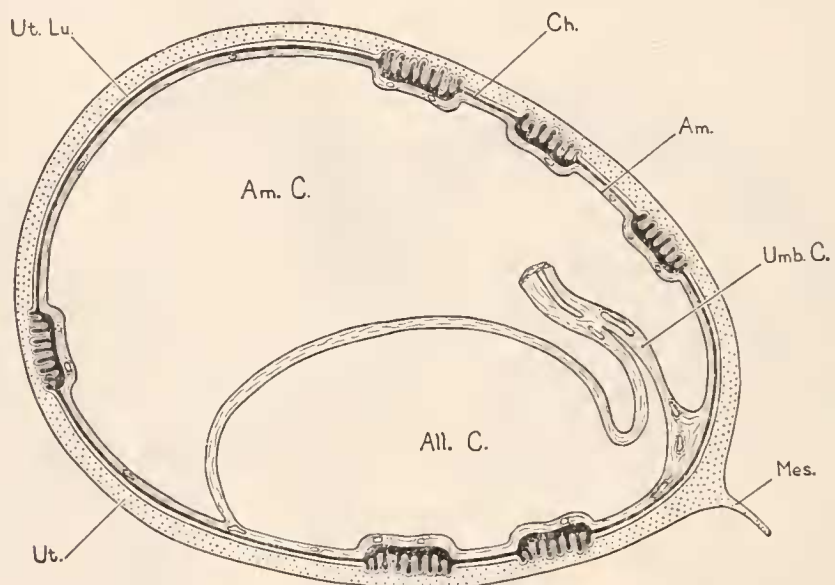

Fig. 2. Diagram of a transected uterine horn illustrating the relationships of the fetal membranes. All. C., Allantoic Cavity; Am., Amnion; Am. C., Amniotic Cavity; Ch., Chorion; Mes., Mesometrium; Umb. C., Umbilical Cord; Ut., Uterus; Ut. Lu., Uterine Lumen.

horn are illustrated diagrammatically in figure 2. Because of the relatively small size of the area of allanto-chorionic fusion the area of contact of chorion and amnion is correspondingly great. Despite the varying degree of actual fusion between chorion and endodermal allantois, the allantoic blood vessels radiate in all directions into the chorionic mesoderm giving rise to a typical chorio-allantoic placenta.

The 2 gestation sacs are fused in the midline in the region of the corpus uteri. A histological section placed through the membranes in this area reveals that the 2 amnions are united back to back, the inter-

vening chorions having undergone complete regression (fig. 5). A few small blood vessels are visible in the mesenchyma uniting the 2 gestation sacs so that one must accept the possibility of vascular ansatomoses existing between them. Yet barring evidence from injected specimens or any observations on the occurrence of free-martins, one would not be justified in assuming a priori that vascular anastomoses actually occur.

THE UMBILICAL CORD

The umbilical cords are short and stout, their lengths in the 4 specimens ranging from 5 to 10 cm. The surfaces of the cords are covered by minute brownish papillae which extend up to 1 mm. in length. Histological sections show these to be papillary thickenings of the amniotic epithelium covering the cord (figs. 6 and 7). These amniotic plaques extend out for only a short distance onto the membranous amnion beyond the confines of the umbilical cord. In cross-section the cord is seen to contain 2 pairs of umbilical blood vessels separated by the slit-shaped lumen of the allantoic duct which lies in the center of the flattened cord (fig. 6). The stroma of the cord is vascularized by minute blood vessels which arise from the umbilical arteries and veins.

THE HISTOLOGY AND CYTOLOGY OF
THE COTYLEDONS

In cross-section the cotyledons are seen to consist of interdigitating fetal and maternal tissues as illustrated in figures 3, 4, and 10. In the small cotyledons the slightest traction on the chorion and uterine wall pulls the fetal and maternal elements apart, and in the larger cotyledons very little more force is required to separate them. When they are pulled asunder, the exposed fetal surface has a shaggy, papillary appearance, whereas the maternal part or caruncle is pitted, illustrating that the cotyledons are composed of fetal villi projecting into mucosal crypts (fig. 12). Examination of histological sections of cotyledons cut horizontally bears out this conclusion. The cross-sections of the fetal villi are observed to lie in compartments created by the septal walls of the mucosal crypts (fig. 9).

The cotyledons of Artiodactyla have been divided into 3 general types. When the endometrium of the cotyledon is polypoid in form and is capped by the chorion, it is said to be convex. When, on the other hand, the endometrium of the cotyledon appears to be excavated

with a wall around the periphery so that the chorion extends into it in a polypoid manner, the cotyledon is described as being concave. But, if the cotyledon is contrived so that its base and top are both relatively flat and the axes of the interdigitating fetal papillae and maternal crypts are more or less parallel to one another instead of being fan-shaped, it is referred to as being flat or intermediate. By reference to figures 3, 4 and 12, it will be observed that the cotyledons of the pronghorned antelope are of the intermediate or flat type.

The cotyledons are sufficiently well preserved in two of the 4 specimens (18 and 23 cm. fetuses) to allow of a reasonably accurate histological and cytological study. Their microscopic structure is portrayed in figures 3, 4, 9, 10 and 11. The primary chorionic villi, projecting into the crypts of the mucosa, are plump, digitiform and tapering (figs. 3 and 4). They give off numerous, extremely short, leaf-like secondary villi at right angles to the primary ones (figs. 4, 9 and 10). Similarly, the compartmental walls of the endometrial crypts bear low folds or rugae which engage with the secondary fetal villi (fig. 10). The maternal and fetal surfaces of these structures in all parts of the cotyledon appear to be completely clothed by epithelium (fig. 11) thus giving rise to a characteristic epithelio-chorial placenta according to the classification of Grosser. The secondary chorionic villi or rugae are separated by troughs or fossae. The latter are lined by low columnar cells, whereas the tips of the folds are covered by cuboidal cells which are variously deformed by their intimate association with a rich and irregular capillary bed. The blood vessels in the chorionic villi form plexuses in which individual capillaries penetrate the epithelium dislocating its cells and spreading them apart. This brings the capillary walls at many points almost to the surface of the villus and reduces the overlying cytoplasm of the epithelium to the thinnest of membranes. It is here doubtlessly that the most direct and readiest interchange, especially of gases and other readily diffusible substances, takes place between the fetal and maternal circulations. At many points the capillaries appear to tunnel the epithelium to a degree which suggests the designation "intraepithelial capillaries."

The columnar epithelial cells lining the fossae between the villi rest upon a delicate, regular basement membrane with which capillaries are associated. The cells are largest in the bottoms of the troughs and diminish in height on the sides of the villi until they become quite small and very irregular toward the tips. At the distal ends of the cells a well-defined brush border and a suggestion of terminal bars are visible. Just beneath the brush border in the distal portion of the cyto-

plasm there is a dusting of bright red acidophilic granules. The brush border is heavier and more distinct on the cells of the fossae than on the cells covering the villi. These various features of the cells are illustrated in figure 11 which was drawn from the rectangular field indicated in figure 10. In sections stained with eosin and methylene blue, the infranuclear portion of the cytoplasm is basophilic whereas the supranuclear half of the cells is acidophilic.

Besides the low columnar and cuboidal cells regularly covering the chorionic folds and the fossae between them, giant cells are encountered in the chorion. These possess a large amount of cytoplasm and one or two nuclei which are frequently hyperchromatic (fig. 11). They are irregularly distributed, in some villi none being seen, whereas in others 3 or 4 may be visible within a short distance of one another. Sometimes they are intercalated between the ordinary chorionic epithelial cells and consequently form part of the surface but more frequently they are located beneath the regular chorionic cells. They appear to occur more frequently on the tips and sides of the secondary villi than in the fossae.

The maternal folds or rugae which interdigitate with the fetal villi consist of a vascular stroma which is covered by epithelium (figs. 10 and 11). The small blood channels penetrate very close to the surface and in many places only a very delicate membrane of cytoplasm intervenes between their lumens and the surface of the endometrium. The epithelial cells covering the endometrium are very much flattened and possess indistinct boundaries. In some places the nuclei are fairly close together and the cytoplasm is quite distinct, but in many other places the nuclei are far apart and the cytoplasm is hardly distinguishable. Where the cytoplasm is thinnest the capillaries lie very close to the surface. The absence of distinct boundaries in the epithelium suggests that it is syncytial (fig. 11) and, indeed, in some places it may be incomplete, although this latter point cannot be proven with the present material.

In the lumen of the uterus between the mucosa and the chorion, especially in pockets which are regularly present between the endometrium and the chorionic fossae, secretion or "uterine milk" is encountered. It is probable that this is mainly secreted by the uterine glands. The brush borders of the chorionic cells project into this secretion and it is presumably absorbed by these cells as nourishment for the fetus. No extravasated maternal blood is visible in the uterine milk or in any other part of the cotyledons.

The uterine glands are simple tubules lined by cuboidal epithelial

cells. Their nuclei and cytoplasm stain deeply with methylene blue, an observation which suggests the presence of ribonucleoprotein in their cytoplasm. The glands appear to be no less numerous beneath the cotyledons than elsewhere. We have not investigated their topography as to shape, length, course, or outlets beyond what has been revealed by occasional histological sections. We have not encountered any of their ducts emptying directly into the endometrial crypts into which the primary fetal villi project which suggests that those beneath the cotyledons may open along their margins. Elsewhere they apparently open directly into the uterine space between the endometrium and the membranous chorion.

The endometrium is clothed by pseudostratified epithelium composed of relatively small irregular cells with vacuolated, basophilic cytoplasm. The membranous chorion also consists of pseudostratified epithelial cells which are individually larger than the endometrial cells and somewhat less basophilic. Between these cells numerous giant cells, identical with those described in the chorionic villi of the cotyledons, are intercalated. These may possess a single large nucleus or 2 smaller, hyperchromatic ones. Because of the relatively imperfect state of fixation, the material does not reveal more cytological details. Between the endometrium and the membranous chorion there is a variable layer of secretion and detritus which is presumably derived from the uterine glands and the uterine surface epithelium.

In the few sections which have been examined, occasional minute areas of the epithelium of the membranous chorion appear to be infolded (fig. 8). These pockets give no evidence of their presence upon naked eye examination of the chorion. They resemble to a slight degree the well-known areolae of the chorion of the sow, but they are simpler in structure and microscopic in dimensions. The pseudostratified, basophilic epithelium lining them borders a narrow lumen which contains material which is faintly acidophilic. We have not ascertained how characteristic of the membranous chorion or how frequent these structures may be.

Decidual transformation of the endometrium does not occur at the maternal surface of the cotyledons or elsewhere in the uterine mucosa. There are no signs of regressive or degenerative changes in the uterine stroma and there is no extravasation of blood from any maternal vessels. Moreover, there is little evidence that the syncytial uterine epithelium has disappeared at all. Since the present specimens are from the middle third of gestation, it is possible that some of the syncytium might regress in late gestation. Yet, up to the middle of

gestation, it is apparent that the placenta is of the epitheliochorial variety rather than of the syndesmochorial type and, if it should eventually become syndesmochorial, it would be for only a relatively brief terminal phase.

What we have called small cotyledons from naked eye examination of the gestation sac prove upon closer examination to be essentially the same as the large cotyledons, the principal difference being that they are smaller and simpler. The chorionic villi and uterine crypts composing them are respectively shorter and shallower and consequently the chorion and mucosa separate more easily than in the larger cotyledons. They range in size downward from the large structures to fields a few millimeters in diameter in which, upon microscopic examination, quite short chorionic villi engage with extremely shallow mucosal crypts and folds. They do not appear to be degenerating structures, but rather to represent smaller, accessory cotyledons which range by transition down to mere patches of villi.

The ovaries. The 4 pairs of ovaries were sliced with a knife. It is of interest that, although each uterus contained twins, examination of the respective pairs of ovaries revealed 4 corpora lutea in each of 2 pairs, and 6 in the 2 others. The discrepancy is probably to be accounted for by the failure of all but 2 of the eggs to implant and maintain themselves. The gross appearance of 1 pair of the sectioned ovaries is shown in figure 1 in which 4 corpora lutea are present.

DISCUSSION

It is of some interest to compare the placentation of the pronghorned antelope with that of other groups of the Artiodactyla. Such comparisons should involve the general form and arrangements of the placenta, as well as the evidence derived from examination of its microscopic structure.

Attempts have been made in the past to compare and classify the placentas of the Perissodactyla and Artiodactyla. They have been divided into those that are diffuse, those which possess a few large cotyledons and those which have numerous smaller cotyledons or in slightly different terminology into acotyledonary, oligocotyledonary and polycotyledonary groups (cf. Andresen, '27). The acotyledonary group includes the Equidae, Tapiridae, Suidae, Camelidae and Tragulidae which so far as is known possess diffuse chorioallantoic placentas provided with short villi. The oligocotyledonary group contains the Cervidae, with the exception of the musk deer (*Moschus moschi-*

ferus), all having a small number (6 to 9) of relatively large cotyledons (tabulated by Andresen '27, p. 428 for a dozen genera). A gravid uterus of *Odocoileus virginianus borealis* in our possession—a species not listed by Andresen—bears out this generalization; the uterus contains a single gestation sac with 6 large cotyledons. The polycotyledonary group comprises the Giraffidae and the Bovidae. The giraffe is said to possess upwards of 180 cotyledons, *Bos taurus* around 100, sheep, goat and chamois between 60 and 140, and antelopes, of which specimens of some 9 genera have been examined, between 20 and 100 (cf. Andresen, '27, and Mossman, '37). *Tetraceros quadricornis* (the 4-horned antelope) contains as few as 20 to 30 (Weldon, '84), and *Adenota kob* is described as possessing only 18 large cotyledons (Krölling, '31). In this regard the pronghorned antelope which we are examining belongs to the polycotyledonary type although like *Tetraceros quadricornis* and *Adenota kob* it has fewer than the average number for the group.

The cotyledons of the Artiodactyla have also been classified according to their shapes, more particularly in reference to the relations of chorion and mucosa as seen in transected cotyledons. They are of 3 general types,—convex, concave and flat or intermediate. In the convex type the mucosa is polypoid and is capped by the chorion; this form is encountered in deer, cattle and some antelopes. The convex type is the reverse of the previous one, the chorion projecting in a polypoid manner into a cupshaped excavation of the mucosa; this is encountered in sheep, goats and chamois. The flat or intermediate type presents maternal and fetal interdigitations arising from broad bases with the consequence that neither is polypoid; this type is encountered in various antelopes as well as in Antilocapra. For a convenient diagrammatic representation of these 3 forms the reader is referred to an article by Mossman ('37, plate 24). In this connection, it is of interest to recall that the cotyledons are regarded as arising on the chorion in relation to specialized permanent elevations which exist in the uterine mucosa (carunculae). Consequently, the size, shape and distribution of the cotyledons appear to be determined in large measure by the mucosa.

It has also been proposed to classify cotyledons on the basis of the thickness and degree of branching of the fetal villi which compose them. The villi have been designated as broad and narrow by Strahl ('11) and Sedlaczek ('12), but Grosser ('27) divides them on a somewhat different basis as follows: (1) digitiform, plump and slightly branched villi as in the roe deer (*Capreolus capreolus*), red deer

(*Cervus elephas*) and antelopes, (2) richly branched villi with expanded, leaf-like terminations as in cattle, and (3) villi which are plump at their bases but at their tips are richly arborized as in sheep and goats.

The chorionic villi of the cotyledons of Antilocapra fit none of these 3 groups exactly, instead seeming to fall between groups 1 and 2. In order to acquaint ourselves at first hand with the topography of the chorionic villi in the cotyledons of various Artiodactyla we undertook a comparative examination of them, using the available literature as well as specimens of our own. These comparisons have impelled us to reclassify the chorionic villi of the cotyledonary placentas of the Artiodactyla as set forth below.

1. Plump, digitiform primary villi with smooth surfaces and some V-shaped branching toward the tips, as in the roe deer and red deer (cf. Grosser, '27), as well as in some antelopes (*Cervicapra* (=Redunca) *bohor*: Sedlaczek, '12 and Andresen, '27; *Adenota kob*: Krölling, '31).

2. Plump, digitiform, tapering primary villi with numerous extremely short, leaf-like, secondary villi arising at right angles from the main stems, as in the pronghorned antelope (*Antilocapra americana*).

3. Slender primary villi with numerous, slender secondary villi arising at right angles and tertiary villi forming V-shaped terminations, as in cattle.

4. Slender primary villi with numerous, slender, secondary and tertiary villi branching principally in a V-shaped manner, as in some deer (*Rangifer tarandus*: Kolster, '09; *Cervus* (=*Mazama*) *rufus*: Andresen, '22) and in at least one antelope (*Rhynchotragus kirkii*: Wislocki, '41). The cotyledons of a Virginia deer (*Odocoileus virginianus borealis*) in our possession also exhibit villi of this character and those of 2 other antelopes (*Hippotragus bakeri*: Sedlaczek, '12, and *Gazella rufifrons*: Krölling, '31) are probably also of this type but the pictures of them are too obscure to allow any definite conclusion to be drawn.

5. Plump primary villi which give rise at the periphery to slender richly arborizing secondary and tertiary villi, as in sheep and goats.

The classification outlined above represents, it is hoped, an advance toward clarifying the intricate patterns of the villi in these groups of animals. Doubtless, as further placental material is studied and other species are added, our scheme will become superseded by a more accurate one. Simple models or reconstructions of villi characteristic of these different species should be extremely instructive. Barring that procedure, investigators would be well advised always to compare the

villi as seen in perpendicular and horizontal sections through a cotyle-
don (e.g. figs. 4, 9 and 10).

Strahl ('11) and Sedlaczek ('12) divide placental cotyledons into
"broad" and "slender" ones on a very different basis from the one
proposed by Grosser which we have adopted and modified in the
preceding paragraphs. Paying no attention whatsoever to the relative
width of individual villi, these authors speak of a "broad" type in the
presence of slender, but richly arborizing villi (e.g., sheep, cow) and
of a "narrow" type in the presence of plump, relatively unbranched
villi (e.g., some deer and antelopes). Their reason for this is that the
former, resembling a tree with widely spreading branches, constitutes
a "broad", fan-shaped arc, whereas the latter, resembling a tree with
fewer, more perpendicular limbs, has a "narrow" spread. This de-
scriptive principle would seem to offer less basis for comparison of
these various forms than the criteria of shape, size and order of
branching of the villi introduced by Grosser and ourselves.

Still another way of classifying the cotyledons of these various ani-
mals is on the basis of the degree of loss of the maternal epithelium
and the amounts of maternal bleeding and decidual reaction which are
present. The answers to these questions, for most of these animals,
are far from satisfactorily known. Yet, it seems evident (Grosser, '27)
that the most extensive degenerative change and decidual transfor-
mation occur in the mucosa of the sheep, the least in the cow and
intermediate degrees in deer. By these tokens the cotyledons of cattle
appear to be epithelio-chorial in nature according to the classification
of Grosser ('27), whereas those of deer and sheep are very definitely
syndesmo-chorial. In the cotyledons of antelopes, in so far as these
features have been investigated, various combinations and degrees of
loss of the uterine epithelium, decidual transformation and blood
extravasates have been described. In *Gazella rufifrons* (Krölling, '31)
and *Hippotragus bakeri* (Sedlaczek, '12) noticeable changes in the
endometrium are described including bleeding. In *Rhynchotragus
kirkii* (Wislocki,'41) decidual alterations without bleeding are recorded,
whereas in *Adenota kob* the changes are so slight that Krölling con-
cludes that its placenta is of the epithelio-chorial type.

The endometrium of the pronghorned antelope does not undergo
any decidual transformation or give rise to extravasations of blood.
Moreover, the uterine epithelium shows little if any loss. In these
particulars its cotyledons resemble those of the cow and of *Adenota
kob*. Consequently it seems justified to conclude that its placentation
is of the epithelio-chorial variety.

Other cytological features of the placenta of Antilocapra include a brush border on the chorionic epithelium and the presence of trophoblastic giant cells many of which are binucleate. Brush borders have been so little studied in the placentas of the groups of animals which are dealt with here that the observation of them fails to offer any basis for comparison. It has been mentioned merely for several forms of deer that the epithelium of the chorionic villi possesses a brush border. As regards trophoblastic giant cells or diplokaryocytes, these have been described in the chorionic epithelium of the cotyledons of a variety of Artiodactyla, including cow and sheep (cf. Grosser, '27) and several antelopes (Krölling, '31, Wislocki, '41). In the cow they have been observed to increase in number as gestation advances.

It is perhaps worth pointing out that the finer histology of the secondary chorionic villi and intervening fossae of the placenta of Antilocapra is very similar to that of the pig's placenta, despite the fact that the one is diffuse and the other cotyledonary. With the exception of the diplokaryocytes which appear to be a feature solely of cotyledonary placentas, the size, shape and cytology of the villi in the 2 are very similar. They have cells of comparable size and arrangement covering the villi and lining the intervening fossae and they are both provided with brush-borders, and acidophilic granules. They are also vascularized in a similar manner. These likenesses will be appreciated by comparing figures 10 and 11 of the present paper with the villi of the pig illustrated in a paper by Wislocki and Dempsey ('46).

In regard to the affinities of the placenta of this animal to the other groups of the Artiodactyla it will have been noticed from the previous comparisons that its placenta has many generalized features which ally it widely to those of the other groups of the order as well as some very distinctive features of its own. Consequently it does not bear a very close resemblance or relationship to any one of the other groups. It will be recalled that it is polycotyledonary (relationship to cattle, antelopes, goats, sheep and giraffes) and of the flat type (relationship to some antelopes). However, in reference to the branching of the chorionic villi it shows only a generalized resemblance to the group, possessing a distinctive topography of its own. In respect to decidual reactions and bleeding it resembles cattle most closely, being farther removed from sheep and goats. The placenta appears to be of the epithelio-chorial variety, in this respect resembling cattle and several of the antelopes. Attention has also been called to the striking histological and cytological similarity of the chorionic villi of Antilocapra to the villi of the pig's placenta. This latter relationship indicates the

very generalized and wide affinities of the placenta of the pronghorned antelope.

SUMMARY

The placenta of the pronghorned antelope (*Antilocapra americana*) has been described for the first time. It is a chorio-allantoic placenta of polycotyledonary type possessing some 20 to 40 larger cotyledons and a lesser number of smaller ones. The cotyledons are round on surface view and of the flat type when viewed in cross-section. The cotyledons possess plump, digitiform, tapering primary chorionic villi which are thickly covered with minute, extremely short secondary villi. There is no observable decidual reaction or bleeding and the epithelium lining the endometrial crypts and folds appears to remain intact; consequently, the placenta is interpreted as being of the epithelio-chorial variety.

In many features the placenta of this animal shows relationships to other groups of the Artiodactyla, without, however, being closely similar to any particular group. Furthermore, the peculiar pattern and manner of branching of the chorionic villi indicate that it is quite distinctively specialized.

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